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H04L 1/08

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H4P PENX

(56) Documents Cited
US 4924456 A

(58) Field of Search
UK CL (Edition P) **H4P PENL PENX PPEC**
INT CL^6 **H04L 1/08 1/12 1/16**
Online:- WPI

(54) Abstract Title
Transmission method with load dependent retransmission facility

(57) In the present invention the opportunity of retransmission is only available when the load, i.e. the amount of information to be transmitted, is low enough to permit buffering of the information for a potential retransmission. Video information is compressed by an encoder 7 which is coupled to a buffer 16 and a load determinator 15. The load determinator measures the amount of information to be transmitted and compares it with a threshold. If the current load is below the threshold, the information transmitted is stored in the buffer and a message is sent with the next transmitted packet indicating that a retransmission is available if required. The station receiving this message either responds by specifying the information required or indicates either explicitly or implicitly that retransmission is not needed.

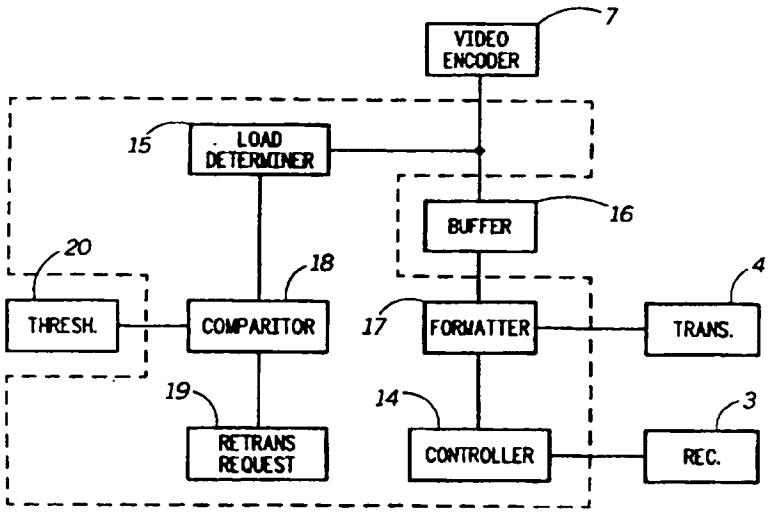

FIG. 3

GB 2 332 343 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

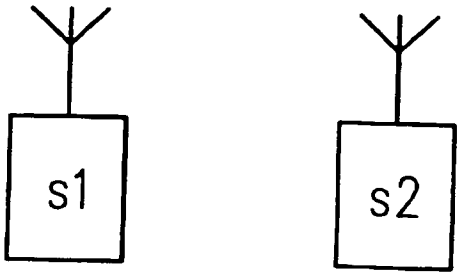

FIG. 1

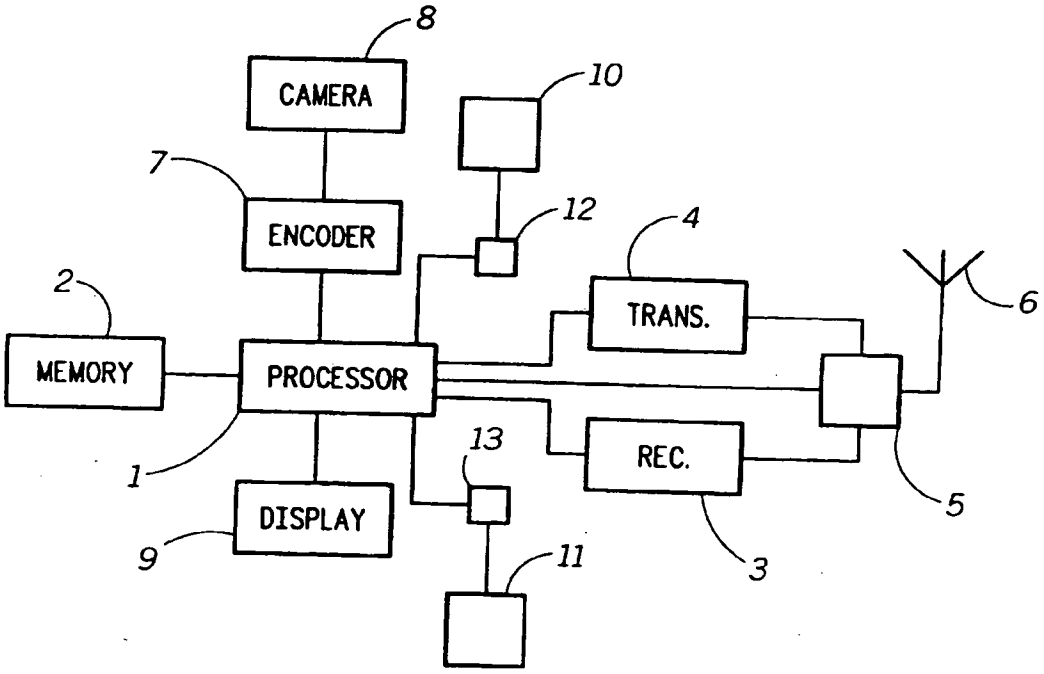

FIG. 2

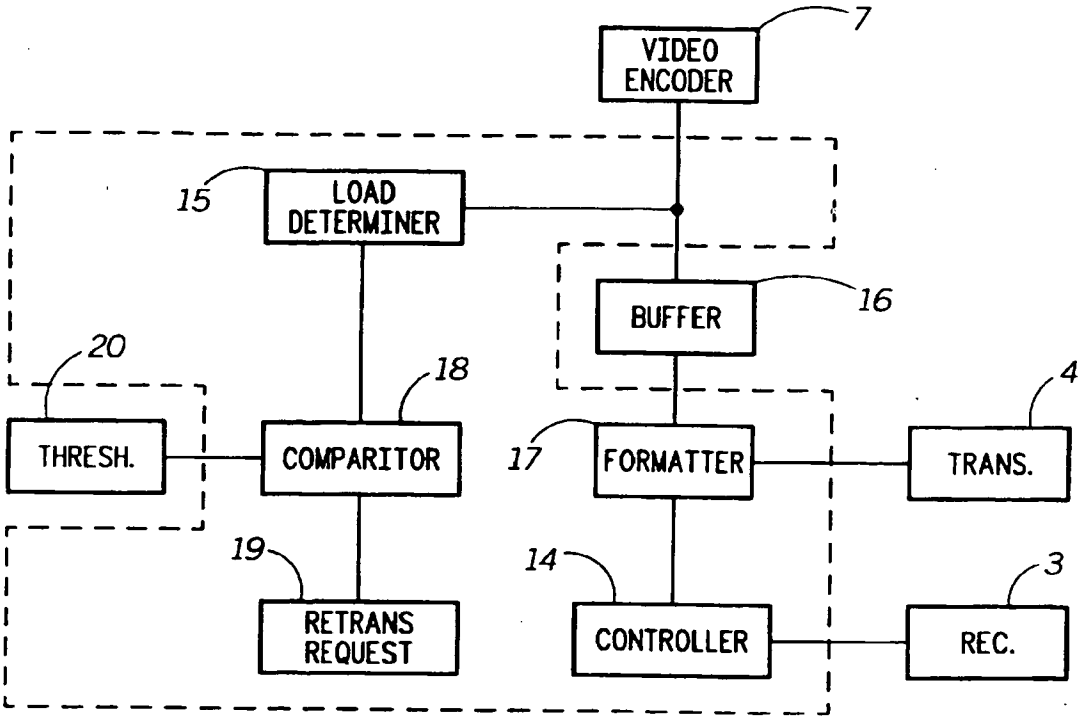

FIG. 3

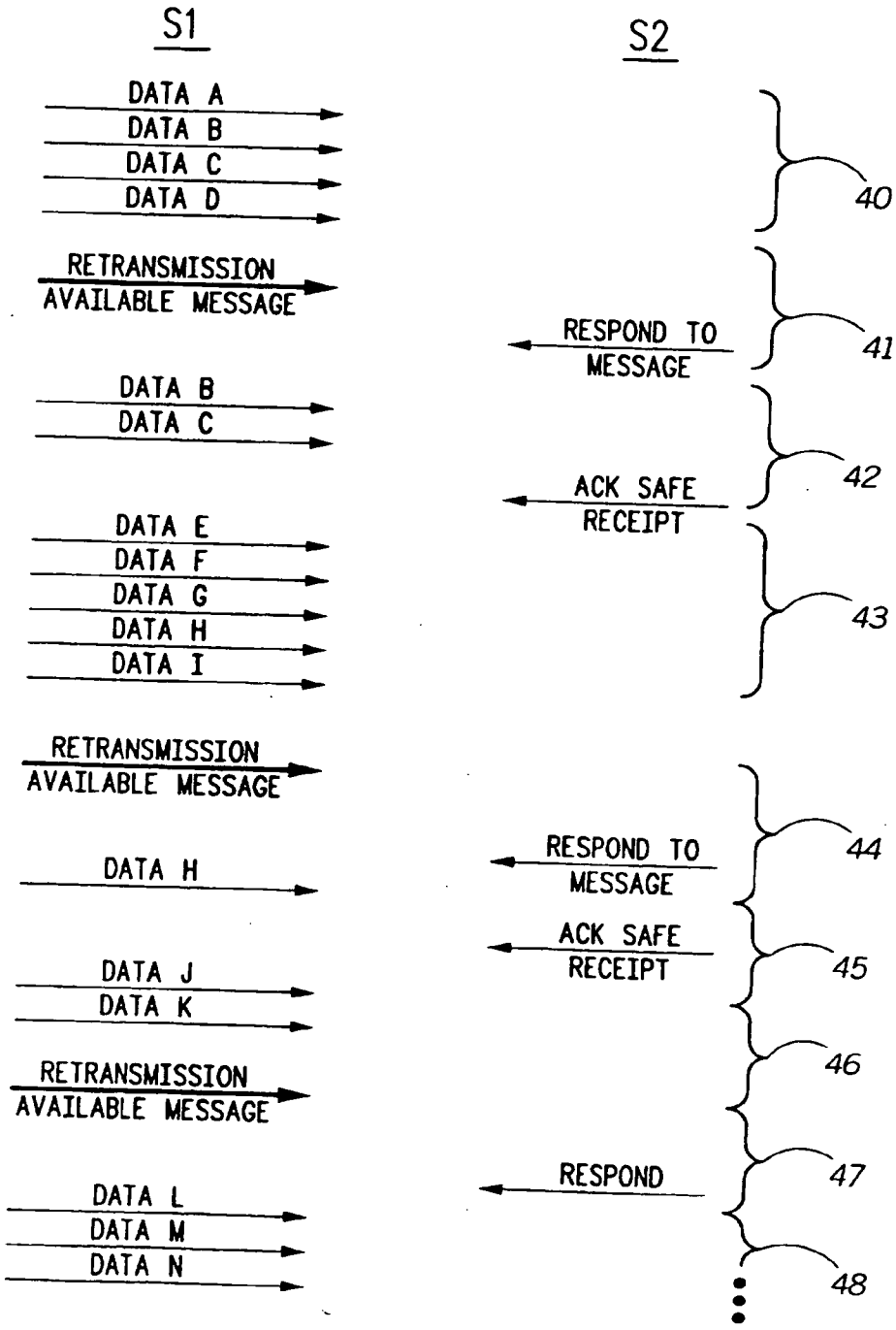

FIG. 4

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A Video Transmission Method And Apparatus

Field Of The Invention

This invention relates to a video transmission method and apparatus for transmitting video, in particular, information by radio.

Background To The Invention

An increasingly familiar sight on our streets is the presence of video cameras. These are used for the purposes of deterring crime and traffic management. Cameras are also used at the scene of accidents by fire and other emergency services to record the incident for future analysis. Live relays of the accident have also been suggested in order that remotely located experts may provide advice to the personnel at the scene. For example, doctors may be able in this way to provide advice to medics at the scene or fire chiefs to firemen at the scene.

There is therefore a requirement to transmit video information by radio.

In order to reduce the bandwidth required for the transmission of video information compression techniques are utilised. One such technique involves the transmission of the difference between a current scene and a previously transmitted scene. Thus, primarily only difference information is transmitted.

Problems with the transmission of information can occur because of the transmission path which will lead to the loss of video information. As a consequence the picture quality at the receiving end may deteriorate or the picture may even be lost.

It is an object of the invention to alleviate the problem of loss of video information.

Summary Of The Invention

According to the invention there is provided a method for video transmission comprising the steps of ; transmitting video information from a first station to a second station in accordance with a video information transmission load, determining a current load at the first station and in response to the determined load transmitting a message to the second station, and at the second station determining whether or not to send a retransmission request to the first station and in response to the message sending the retransmision request.

By transmitting a message to the second station in response to the determined load it is possible to ensure that a retransmission request from the second station occurs at a time when the video information load at the first station is relatively low. Because the load is relatively low the first station will be able to buffer the incoming video information, from, say, its local video camera, without the buffer capacity being exceeded. This means that the video transmission process can be interrupted to permit a retransmission without the loss of current or, rather, more recent video information.

Load is here used in the sense of the amount of video information that has to be transmitted.

Another advantage of the invention is that the first station transmits a message to the second station indicating that it is possible if necessary to request retransmission. This is more efficient than, say, establishing a protocol in which a particular time slot is allocated for a retransmission request for that slot will often be effectively wasted because it is unused.

A yet further advantage is that the first station will be able to operate without interruption, that is to say, it will only have to monitor for retransmission requests at a time it determines because the

retransmission request (if required) is sent in response to the message. This is particularly important where a codec is used in the first station for if a codec's operation is interrupted it may result in a loss of data.

Brief Description Of The Drawings

A specific embodiment of the invention will now be described by way of example only with reference to the following drawings in which:

Figure 1 shows in schematic block diagram form a communication system operating in accordance with the invention;
Figure 2 shows in block diagram form a station used in the system shown in Figure 1; and
Figure 3 is an explanatory diagram.

Specific Embodiment

Figure 1 shows a communication system including two stations s1 and s2. The stations are nominally identical both having the ability to transmit and to receive video information.

As is shown in figure 2, the stations include a microprocessor 1, a memory 2, a receiver section 3, a transmitter section 4, an antenna switch 5, an antenna 6, a video encoder 7, a video camera 8 , a colour liquid crystal display 9, a microphone and amplifier 10, a speaker 11, an analogue to digital converter 12 and a digital to analogue converter 13. All these components are of a known type although the microprocessor 1 is programmed to operate in a novel and inventive way.

The microprocessor 1 provides the necessary "intelligence" to the station and operates in accordance to a software program held in the memory 2. The microprocessor 1 is coupled to the memory 2 by a databus. It is also

coupled to the video encoder 7, the receiver section 3, the transmitter section 4 and to the antenna switch 5.

The video camera 8 is arranged to view a scene and to produce video information based on the scene to be transmitted from one station to the other. The output of the camera 8 is encoded by the video encoder 7 into a compressed form. The compressed encoded data is passed to the microprocessor 1 and processed into a form suitable for transmission by the transmitter section 4.

The antenna switch 5 is responsive to a control signal from the microprocessor 1 to selectively couple the receiver section 3 or the transmitter section 4 to the antenna 6. Thus, when a transmission is to be made the transmitter section 4 is coupled to the antenna 6. When the station is not transmitting the receiver section 5 is coupled to the antenna 6.

The analogue to digital converter 12 couples the output provided by the microphone and amplifier 10 to microprocessor 1 converting as it does so the analogue sound signals to digital signals.

Similarly, the digital to analogue converter converts digital signals from the microprocessor 1 and passes the resultant analogue signals to the amplifier and speaker 11.

The video camera 8 produces a digital output which is in the form of frames. The frames are processed by the video encoder 7 and compressed in a known compression technique in this case H.263 MPEG4 (or equivalent). The output of the video encoder 7 is the difference between the current scene and an earlier scene held in memory. The difference information is passed to the microprocessor 1.

The microprocessor 1 is programmed to provide a number of units of functionality as is shown in figure 3.

The units include a controller 14, a load determiner 15, a buffer 16, a formatter 17, a comparitor 18, a retransmission request unit 19 and threshold load memory 20. The buffer 16 and the threshold memory 20 are configured in the memory 2 by the microprocessor 1 and comprise a set of addessable memory locations.

The way in which the video information is transmitted will now be described. The video information is provided from the video camera and to the video encoder 7. The video encoder 7 compresses the information using the compression technique.
The resultant compressed data is passed to the buffer 16 where it is held pending downloading by the formatter 17 or overwriting when the buffer capacity is exceeded.

The formatter 17 loads the compressed data into a packet format appropriate to the communication protocol being used. The packet is then passed to the transmitter section 4 for transmission to the other unit.

It will be seen that the output of the video encoder 7 is coupled to the buffer 16 and also to the load determiner 15. The load determinator 15 produces a measure of the current load that is to say the amount of information to be transmitted. This will be high if there is a lot of change in the scene being captured by the video camera and low if there is relatively little change. This value is passed to the comparitor 18 which compares it with a threshold load value from the threshold load memory 20. If the value is lower than the threshold then a flag is passed to the retransmission request unit 19. The retransmission request unit 19 then instructs the formatter 17 to send a message in the next packet of data to be sent indicating that a retransmission may now be requested. The other unit, if it has failed to receive any of the video information, will then respond by sending a packet with a payload indicating the data to be retransmitted. This is the retransmission request. This could specify, data relating to the frames or part of frames to be retransmitted.

When a retransmission request is received, the controller 14 reads the payload and instructs the formatter 17 to re-access the appropriate data from the buffer 16. The formatter 17 then packages the data into a further packet which is than retransmitted by the transmitter section 4. The formatter 17 then returns to transmitting the buffered data from the point at which its operation was interrupted by the controller 14 for the retransmission.

A fuller explanation of the protocol involved will now be described with reference to explanatory Fig. 4.

In a first phase labelled 40, S1 transmits video information to S2. In this phase it transmits video data blocks A to D.

A second phase 41 is initiated when the load on S1 is such that it has the capacity to successfully buffer incoming video information from its video encoder 7. S1 then transmits a message indicating that retransmission is available. S2 responds to S1 that either no retransmission is required or that one is required. (In default, after a time out, S1 would assume that no retransmission is required.)

In this case S2 requires retransmission of Data B and C. S1 transmits Data B and C and S2 acknowledges safe receipt. S1 is then able to return to a "normal" transmission phase phase 43. In this phase, Data E to I is transmitted from S1 to S2.

Phase 43 ends when the load at S1 is such that the normal transmission process can be interrupted as at the end of phase 40. Then phase 44 starts by S1 sending to S2 a retransmission available message. S2 responds to S1. The response in this case requires retransmission of Data H.

In a next phase, phase 45, S1 retransmits to S2 Data H. S2 acknowledges safe receipt and this phase terminates. S1 returns to the next

transmission phase, phase 46. This is a relatively short phase in which Data J and K is transmitted. It is a relatively short period because the load is relatively low.

After phase 46, S1 transmits a further retransmission available message to S2 and S2 responds. This is phase 47. In this case S2 has not missed any data and the respond message indicates that no retransmission is required. The next phase, phase 48 is therefore a normal transmission phase in which Data L to N is transmitted. The process continues as before.

Claims

1. A method for video transmission comprising the steps of:

transmitting video information from a first station to a second station in accordance with a video information transmission load,

determining a current load at the first station and in response to the determined load,

transmitting a message to the second station,

and at the second station

determining whether or not to send a retransmission request to the first station and in response to the message sending the retransmission request.

2. A method as claimed in claim 1 comprising:

at the first station

transmitting video information in response to the retransmission request.

3. A method as claimed in claims 1 or claim 2 wherein the retransmission request specifies the video information to be transmitted.

4. A method as claimed in any one of claims 1, 2 or 3, wherein in the absence of a retransmission request the first station continues transmitting video information.

5. A method substantially as hereinbefore described with reference to and or as illustrated by the drawings.

6. Apparatus for transmitting video information comprising:

first and second stations each including a transmitter and a receiver;

the first station further comprising:

a load determinator for providing an output indicative of the load;

a retransmission request unit responsive to the output indicative of the load to issue a message to be transmitted from the first station indicating that retransmission is available;

the second station further comprising:

a unit responsive to the message to transmit from the transmitter a retransmission request.

7. Apparatus for transmitting video information substantially as hereinbefore described with reference to and as illustrated by the drawings.

Amendments to the claims have been filed as follows

Claims

1. A method for video transmission comprising the steps of:

transmitting video information from a first station to a second station in accordance with a video information transmission load,

determining a current load as hereinbefore defined at the first station and in response to the determined load,

transmitting a message to the second station indicating whether retransmission is available,

and at the second station

determining whether or not to send a retransmission request to the first station and in response to the message sending the retransmission request.

2. A method as claimed in claim 1 comprising:
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transmitting video information in response to the retransmission request.

3. A method as claimed in claims 1 or claim 2 wherein the retransmission request specifies the video information to be transmitted.

4. A method as claimed in any one of claims 1, 2 or 3, wherein in the absence of a retransmission request the first station continues transmitting video information.

5. A method substantially as hereinbefore described with reference to and or as illustrated by the drawings.

6. Apparatus for transmitting video information comprising:
first and second stations each including a transmitter and a receiver;
the first station further comprising:

a load determinator for providing an output indicative of the load as hereinbefore defined;

a retransmission request unit responsive to the output indicative of the load to issue a message to be transmitted from the first station indicating that retransmission is available;

the second station further comprising:

a unit responsive to the message to transmit from the transmitter a retransmission request in the event a retransmission is required.

7. Apparatus for transmitting video information substantially as hereinbefore described with reference to and as illustrated by the drawings.

The Patent Office

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Application No: GB 9726038.4
Claims searched: 1-6

Examiner: Matthew Nelson
Date of search: 21 April 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4P (PENL, PENX, PPEC)

Int Cl (Ed.6): H04L 1/08, 1/12, 1/16

Other: Online:- WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 4924456 (MAXWELL et al). See col. 5, lines 45-49 & col. 19, lines 8-51	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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(58) Field of Search
UK CL (Edition P) **H4P PENL PENX PPEC**
INT CL^6 **H04L 1/08 1/12 1/16**
Online:- WPI

(54) Abstract Title
Transmission method with load dependent retransmission facility

(57) In the present invention the opportunity of retransmission is only available when the load, i.e. the amount of information to be transmitted, is low enough to permit buffering of the information for a potential retransmission. Video information is compressed by an encoder 7 which is coupled to a buffer 16 and a load determinator 15. The load determinator measures the amount of information to be transmitted and compares it with a threshold. If the current load is below the threshold, the information transmitted is stored in the buffer and a message is sent with the next transmitted packet indicating that a retransmission is available if required. The station receiving this message either responds by specifying the information required or indicates either explicitly or implicitly that retransmission is not needed.

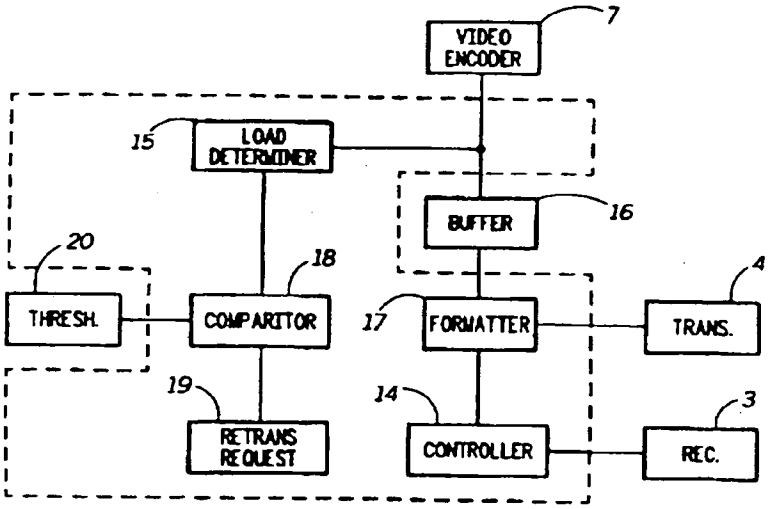

FIG. 3

GB 2 332 343 A

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A Video Transmission Method And Apparatus

Field Of The Invention

This invention relates to a video transmission method and apparatus for transmitting video, in particular, information by radio.

Background To The Invention

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Problems with the transmission of information can occur because of the transmission path which will lead to the loss of video information. As a consequence the picture quality at the receiving end may deteriorate or the picture may even be lost.

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By transmitting a message to the second station in response to the determined load it is possible to ensure that a retransmission request from the second station occurs at a time when the video information load at the first station is relatively low. Because the load is relatively low the first station will be able to buffer the incoming video information, from, say, its local video camera, without the buffer capacity being exceeded. This means that the video transmission process can be interrupted to permit a retransmission without the loss of current or, rather, more recent video information.

Load is here used in the sense of the amount of video information that has to be transmitted.

Another advantage of the invention is that the first station transmits a message to the second station indicating that it is possible if necessary to request retransmission. This is more efficient than, say, establishing a protocol in which a particular time slot is allocated for a retransmission request for that slot will often be effectively wasted because it is unused.

A yet further advantage is that the first station will be able to operate without interruption, that is to say, it will only have to monitor for retransmission requests at a time it determines because the

retransmission request (if required) is sent in response to the message. This is particularly important where a codec is used in the first station for if a codec's operation is interrupted it may result in a loss of data.

Brief Description Of The Drawings

A specific embodiment of the invention will now be described by way of example only with reference to the following drawings in which:

Figure 1 shows in schematic block diagram form a communication system operating in accordance with the invention;
Figure 2 shows in block diagram form a station used in the system shown in Figure 1; and
Figure 3 is an explanatory diagram.

Specific Embodiment

Figure 1 shows a communication system including two stations s1 and s2. The stations are nominally identical both having the ability to transmit and to receive video information.

As is shown in figure 2, the stations include a microprocessor 1, a memory 2, a receiver section 3, a transmitter section 4, an antenna switch 5, an antenna 6, a video encoder 7, a video camera 8 , a colour liquid crystal display 9, a microphone and amplifier 10, a speaker 11, an analogue to digital converter 12 and a digital to analogue converter 13. All these components are of a known type although the microprocessor 1 is programmed to operate in a novel and inventive way.

The microprocessor 1 provides the necessary "intelligence" to the station and operates in accordance to a software program held in the memory 2. The microprocessor 1 is coupled to the memory 2 by a databus. It is also

coupled to the video encoder 7, the receiver section 3, the transmitter section 4 and to the antenna switch 5.

The video camera 8 is arranged to view a scene and to produce video information based on the scene to be transmitted from one station to the other. The output of the camera 8 is encoded by the video encoder 7 into a compressed form. The compressed encoded data is passed to the microprocessor 1 and processed into a form suitable for transmission by the transmitter section 4.

The antenna switch 5 is responsive to a control signal from the microprocessor 1 to selectively couple the receiver section 3 or the transmitter section 4 to the antenna 6. Thus, when a transmission is to be made the transmitter section 4 is coupled to the antenna 6. When the station is not transmitting the receiver section 5 is coupled to the antenna 6.

The analogue to digital converter 12 couples the output provided by the microphone and amplifier 10 to microprocessor 1 converting as it does so the analogue sound signals to digital signals.

Similarly, the digital to analogue converter converts digital signals from the microprocessor 1 and passes the resultant analogue signals to the amplifier and speaker 11.

The video camera 8 produces a digital output which is in the form of frames. The frames are processed by the video encoder 7 and compressed in a known compression technique in this case H.263 MPEG4 (or equivalent). The output of the video encoder 7 is the difference between the current scene and an earlier scene held in memory. The difference information is passed to the microprocessor 1.

The microprocessor 1 is programmed to provide a number of units of functionality as is shown in figure 3.

The units include a controller 14, a load determiner 15, a buffer 16, a formatter 17, a comparitor 18, a retransmission request unit 19 and threshold load memory 20. The buffer 16 and the threshold memory 20 are configured in the memory 2 by the microprocessor 1 and comprise a set of addessable memory locations.

The way in which the video information is transmitted will now be described. The video information is provided from the video camera and to the video encoder 7. The video encoder 7 compresses the information using the compression technique.
The resultant compressed data is passed to the buffer 16 where it is held pending downloading by the formatter 17 or overwriting when the buffer capacity is exceeded.

The formatter 17 loads the compressed data into a packet format appropriate to the communication protocol being used. The packet is then passed to the transmitter section 4 for transmission to the other unit.

It will be seen that the output of the video encoder 7 is coupled to the buffer 16 and also to the load determiner 15. The load determinator 15 produces a measure of the current load that is to say the amount of information to be transmitted. This will be high if there is a lot of change in the scene being captured by the video camera and low if there is relatively little change. This value is passed to the comparitor 18 which compares it with a threshold load value from the threshold load memory 20. If the value is lower than the threshold then a flag is passed to the retransmission request unit 19. The retransmission request unit 19 then instructs the formatter 17 to send a message in the next packet of data to be sent indicating that a retransmission may now be requested. The other unit, if it has failed to receive any of the video information, will then respond by sending a packet with a payload indicating the data to be retransmitted. This is the retransmission request. This could specify, data relating to the frames or part of frames to be retransmitted.

When a retransmission request is received, the controller 14 reads the payload and instructs the formatter 17 to re-access the appropriate data from the buffer 16. The formatter 17 then packages the data into a further packet which is than retransmitted by the transmitter section 4. The formatter 17 then returns to transmitting the buffered data from the point at which its operation was interrupted by the controller 14 for the retransmission.

A fuller explanation of the protocol involved will now be described with reference to explanatory Fig. 4.

In a first phase labelled 40, S1 transmits video information to S2. In this phase it transmits video data blocks A to D.

A second phase 41 is initiated when the load on S1 is such that it has the capacity to successfully buffer incoming video information from its video encoder 7. S1 then transmits a message indicating that retransmission is available. S2 responds to S1 that either no retransmission is required or that one is required. (In default, after a time out, S1 would assume that no retransmission is required.)

In this case S2 requires retransmission of Data B and C. S1 transmits Data B and C and S2 acknowledges safe receipt. S1 is then able to return to a "normal" transmission phase phase 43. In this phase, Data E to I is transmitted from S1 to S2.

Phase 43 ends when the load at S1 is such that the normal transmission process can be interrupted as at the end of phase 40. Then phase 44 starts by S1 sending to S2 a retransmission available message. S2 responds to S1. The response in this case requires retransmission of Data H.

In a next phase, phase 45, S1 retransmits to S2 Data H. S2 acknowledges safe receipt and this phase terminates. S1 returns to the next

transmission phase, phase 46. This is a relatively short phase in which Data J and K is transmitted. It is a relatively short period because the load is relatively low.

After phase 46, S1 transmits a further retransmission available message to S2 and S2 responds. This is phase 47. In this case S2 has not missed any data and the respond message indicates that no retransmission is required. The next phase, phase 48 is therefore a normal transmission phase in which Data L to N is transmitted. The process continues as before.

Claims

1. A method for video transmission comprising the steps of:

transmitting video information from a first station to a second station in accordance with a video information transmission load,

determining a current load at the first station and in response to the determined load,

transmitting a message to the second station,

and at the second station

determining whether or not to send a retransmission request to the first station and in response to the message sending the retransmission request.

2. A method as claimed in claim 1 comprising:

at the first station

transmitting video information in response to the retransmission request.

3. A method as claimed in claims 1 or claim 2 wherein the retransmission request specifies the video information to be transmitted.

4. A method as claimed in any one of claims 1, 2 or 3, wherein in the absence of a retransmission request the first station continues transmitting video information.

5. A method substantially as hereinbefore described with reference to and or as illustrated by the drawings.

6. Apparatus for transmitting video information comprising:

first and second stations each including a transmitter and a receiver;

the first station further comprising:

a load determinator for providing an output indicative of the load;

a retransmission request unit responsive to the output indicative of the load to issue a message to be transmitted from the first station indicating that retransmission is available;

the second station further comprising:

a unit responsive to the message to transmit from the transmitter a retransmission request.

7. Apparatus for transmitting video information substantially as hereinbefore described with reference to and as illustrated by the drawings.

Amendments to the claims have been filed as follows

Claims

1. A method for video transmission comprising the steps of:

transmitting video information from a first station to a second station in accordance with a video information transmission load,

determining a current load as hereinbefore defined at the first station and in response to the determined load,

transmitting a message to the second station indicating whether retransmission is available,

and at the second station

determining whether or not to send a retransmission request to the first station and in response to the message sending the retransmission request.

2. A method as claimed in claim 1 comprising:

at the first station

transmitting video information in response to the retransmission request.

3. A method as claimed in claims 1 or claim 2 wherein the retransmission request specifies the video information to be transmitted.

4. A method as claimed in any one of claims 1, 2 or 3, wherein in the absence of a retransmission request the first station continues transmitting video information.

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6. Apparatus for transmitting video information comprising:

first and second stations each including a transmitter and a receiver;

the first station further comprising:

a load determinator for providing an output indicative of the load as hereinbefore defined;

a retransmission request unit responsive to the output indicative of the load to issue a message to be transmitted from the first station indicating that retransmission is available;

the second station further comprising:

a unit responsive to the message to transmit from the transmitter a retransmission request in the event a retransmission is required.

7. Apparatus for transmitting video information substantially as hereinbefore described with reference to and as illustrated by the drawings.

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Application No: GB 9726038.4 **Examiner:** Matthew Nelson
Claims searched: 1-6 **Date of search:** 21 April 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4P (PENL, PENX, PPEC)

Int Cl (Ed.6): H04L 1/08, 1/12, 1/16

Other: Online:- WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 4924456 (MAXWELL et al). See col. 5, lines 45-49 & col. 19, lines 8-51	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

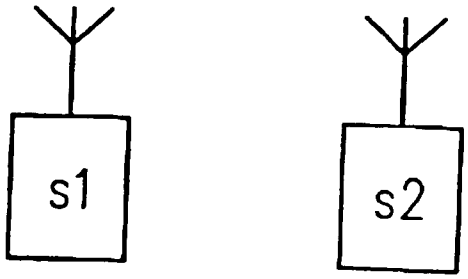

FIG. 1

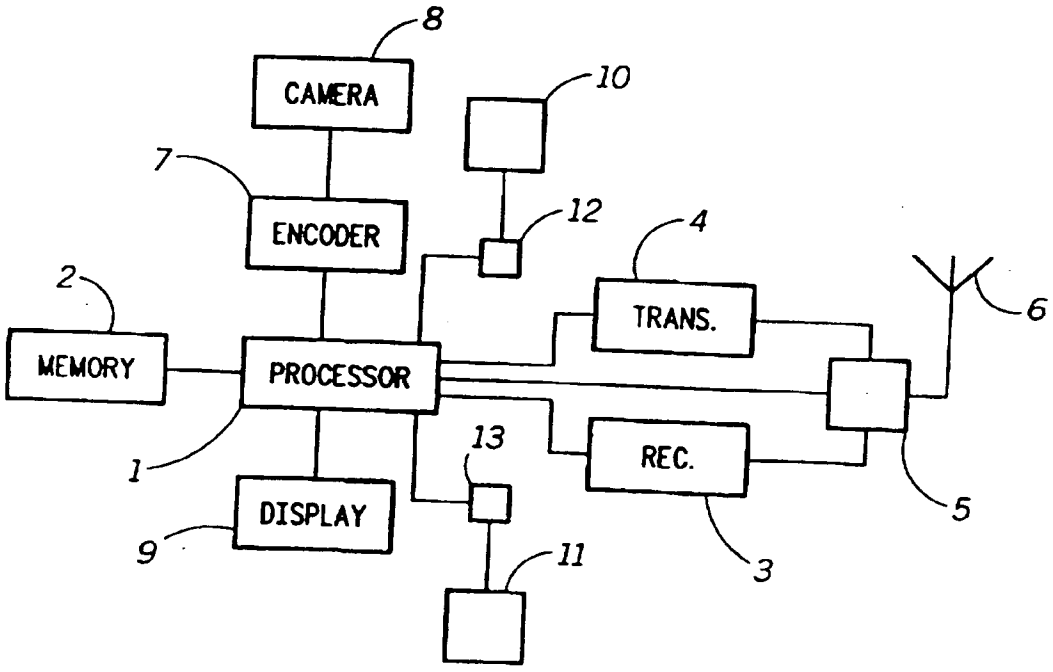

FIG. 2

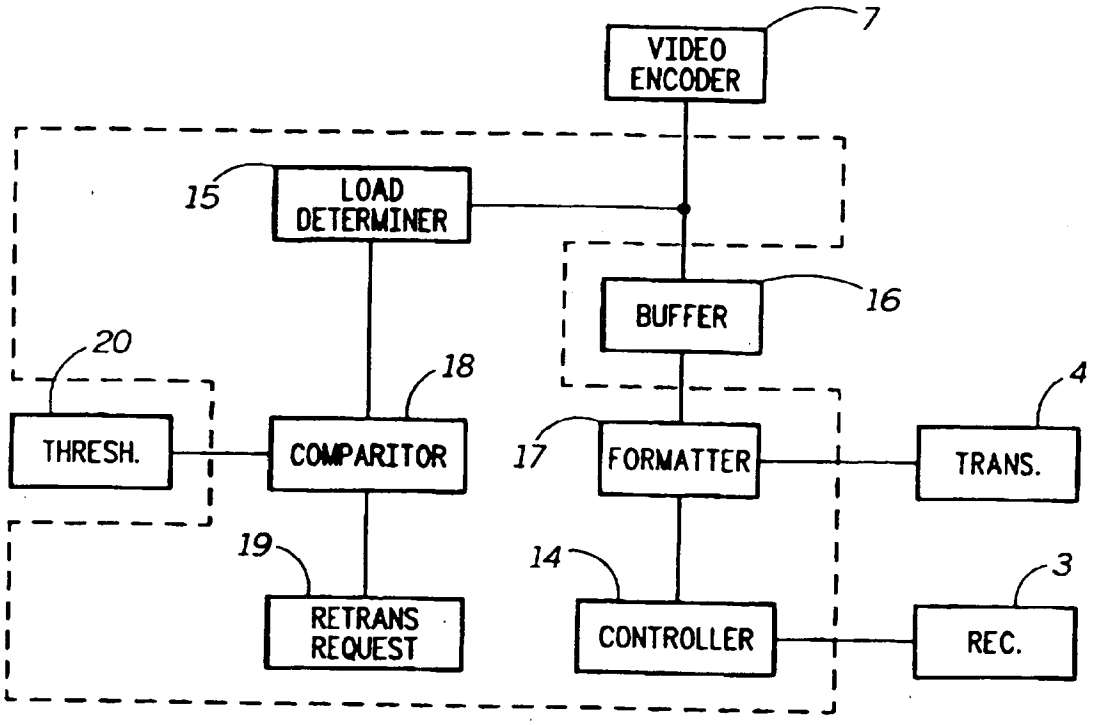

FIG. 3

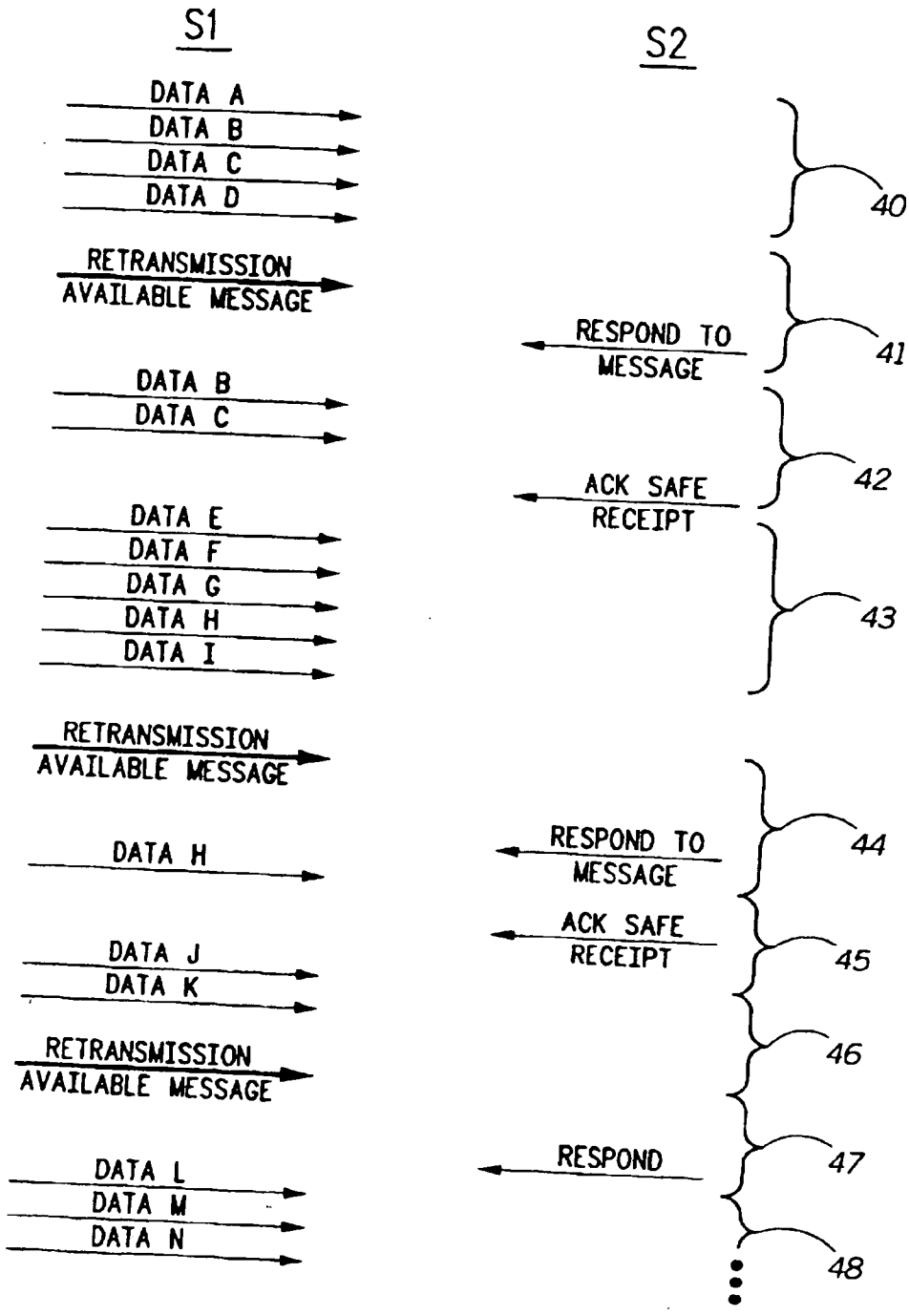

FIG. 4